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Dirty Tanks and Totes are No Laughing Matter

Modern impingement cleaning technologies improve safety and sustainability

By Sheila Kennedy, Contributing Writer

INDUSTRIAL VESSELS of various types are used extensively in the processing of chemicals, petrochemicals, and pharmaceuticals. Applications commonly involve storage or process tanks, drums, blenders, reactors, kettles, mixers, fermenters or shipping containers (Figure 1). In addition, reusable totes and intermediate bulk containers (IBCs) provide for convenient and cost-effective storage and transport.

The cleaning of this essential equipment has long

been a challenge. Liquids, granules and powders of all sorts are contained in these vessels, many of which are viscous and prone to blockages or clogging. Stubborn soils or residues may linger from certain chemicals, paints, adhesives, petroleum and pharmaceutical products or their ingredients, such as coating resins. The consequences of improper cleaning are ultimately reflected in the company's bottom line.

Fortunately, there are easy-to-implement solutions to this often-overlooked problem. Modern tank and tote cleaning devices significantly reduce the cost of cleaning while delivering benefits to workforce safety and the environment. Compared to manual methods, today's cleaning solutions are able to:

- Decrease cleaning times by 75–85%.
- Increase productivity up to 20%.
- Reduce water and chemical usage by 70–80%.
- Reduce or eliminate confined space entry by 100%.
- Achieve cleaning effectiveness of 100%.

ADDRESSING CHALLENGES

There are five primary business challenges associated with dirty totes, tanks and other chemical processing vessels:

1. *Dirty tanks are the enemy of consistency.* Product consistency and quality begins with a clean vessel. Vessels used to manufacture multiple different products are susceptible to cross-contamination, because without proper cleaning, residual product from one batch can contaminate and spoil the next batch. The reusable nature of totes and IBCs makes cleaning them a particular challenge. The cleaning equipment selected must be adaptable to changing residue types and operating conditions.

“We hear from companies daily that have had product recalls due to cross-contamination. Some



Figure 1. Modern cleaning equipment can safely and sustainably clean storage or process tanks, drums, blenders, reactors, kettles, mixers, shipping containers and more.

have thrown away thousands of gallons of product due to spoilage,” says Andrew Delaney, executive vice president at Alfa Laval’s North American Tank Cleaning Competency Center.

2. *Manual tank cleaning is unsafe.* Entering an industrial vessel carries inherent risks. Unfortunately, many companies don’t realize that an alternative to manual tank cleaning exists. Under no circumstance should any person be put in jeopardy to clean a tank or vessel, says Delaney. “Our hope is that once a customer is educated on the alternatives, they will take advantage of the latest technological advances.”

3. *Conservation goals are prevalent.* For environmental and financial reasons, processing and manufacturing companies are striving to use less water, chemicals, energy, and materials to produce their products. Many companies have departments dedicated to sustainability in order to reduce their environmental footprint. The added benefit of sustainability is lower operating costs and higher profitability.

Water and energy consumption is easier to manage with the right cleaning technologies. Water conservation especially is growing in importance. “Water has become a valued commodity in portions of North America and the world,” notes Delaney. Material waste and spoilage is also avoided with better quality cleaning.

4. *Efficiency improves profitability.* Faster, more efficient cleaning allows for more time in production. It decreases the time allotted for cleaning, allowing for higher operational throughput, and it avoids build-up and other issues that could slow the process, enabling increased capacity. Many companies have incentives based upon production goals, and with today’s cleaning technologies, the goals may be exceeded.

More efficient cleaning also allows for greater labor productivity. Replacing time-consuming manual approaches with mechanical cleaning processes leaves more time available to complete higher-value tasks. These savings, plus the efficiencies generated through conservation and avoiding high-cost spoilage and waste, translate directly to higher profitability.

5. *The regulatory effect.* The U.S. Department of Occupational Safety and Health Administration (OSHA) heavily regulates the use of confined space entry for manual tank cleaning, and requires

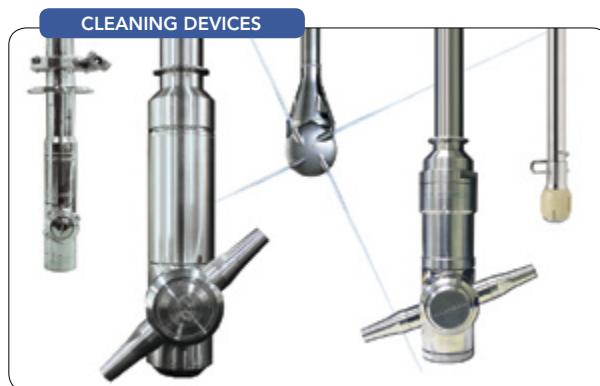


Figure 2. Each Alfa Laval tank cleaning device is uniquely customized to ensure every type of tank or vessel can be optimally cleaned.

proper safety precautions. Though this compliance can be expensive and labor-intensive, companies can face stiff penalties for putting laborers in harm’s way.

“It pains me when I read about someone getting harmed when they enter a tank for cleaning purposes. With all the cleaning options available today, there is just no reason to have people enter a tank for that purpose,” says Delaney. “I think the regulations will continue to evolve to protect the worker from harm, and this will be a good development.”

Tank and vessel cleanliness is also covered in regulations such as the U.S. Food and Drug Administration’s Good Manufacturing Practice (GMP/CGMP), the Environmental Protection Agency’s Transportation Equipment Cleaning Effluent Guidelines, and the European Hygienic Engineering and Design Group (EHEDG) Guidelines. In addition, certain state and local regulations address this topic. Again, the consequences for noncompliance can be substantial.

CLEANING METHOD CONSIDERATIONS

The goal when choosing a cleaning method is to optimize vessel cleaning while limiting the amount of time and waste in the total cleaning cycle. There is no universal solution (Figure 2). Each application must be assessed separately for its unique variables, and in some circumstances multiple machines may be necessary to ensure complete cleaning.

The primary factors that determine the proper cleaning method include:

- Size of the tank;
- Substance being cleaned;



- Obstructions in the tank such as agitators, mixers, baffles or impellers, and;
- Available temperature, pressure and flow rate of the wash fluid at the facility.

Additional considerations include:

- Number and size of available tank openings to insert a tank cleaning device;
- Size of the drain, so the tank does not fill up while being cleaned;
- Whether the outlets are aided by suction or gravity, and;
- Any cleaning chemicals being used.

Creativity may be required to overcome likely challenges, such as inadequate pressure and flow, or no opening exists, or the opening is too small to insert the proper tank cleaning device. “We often see complex internal obstructions that require multiple cleaning devices, but there are limited available openings,” says Delaney. “There are solutions to all of the challenges.”

CONVENTIONAL CLEANING METHODS

Manual cleaning and static spray ball methods have existed for decades, but each has limitations. Another, less desirable option is boiling out or fill-and-drain cleaning.

Manual cleaning with a hose, pressure washer, or other scrubbing mechanism starts with suiting up in personal protective equipment (PPE) to mitigate obvious safety hazards (Figure 3). Persons entering or reaching into a tank or vessel are subject to falling, skin and eye irritants, and inhaling noxious fumes. Inconsistent levels of training and experience of the cleaning personnel exposes the process to human error, and an absence of repeatable cleaning coverage and quality from one cleaning to the next. The existence of, and adherence to, sound standard operating procedures is another concern of manual cleaning.

Static spray balls are simple devices designed to cascade the cleaning solution and erode away residue from the walls of a tote or tank. They can be effective for cleaning easy products such as powders and less-viscous, water-soluble liquids, and they have a low initial purchase price and can easily be changed out. On the other hand, they are not effective for cleaning stubborn residues as they lack mechanical force; they consume large amounts of water and chemicals; the cleaning process can be time consuming in the wrong applications; and they contribute to higher operating costs over the life of the tank.

The boiling out/fill-and-drain method involves filling the vessel with a concentrated chemical solution and then heating the tank to remove the toxins and residues. This

CONFINED SPACE ENTRY



Figure 3. Manual cleaning in confined spaces raises safety, human error, and labor cost concerns.

method is unreliable, time-consuming, and requires excessive amounts of water.

MODERN CLEANING ALTERNATIVES

Today’s advanced tank cleaning technologies such as Alfa Laval’s Gamajet and Toftejorg rotary spray heads and rotary jet heads deliver faster, more effective and reliable cleaning. They eliminate the safety risks associated with sending personnel into a tank or vessel, and they take the unpredictability out of the quality of the cleaning. In addition, they improve the efficiency and sustainability of the total cleaning cycle, enabling shorter tank and process downtimes and the potential for greater production.

Rotary spray heads are wetting devices that create a “sheeting” action on the entire tank wall within the specified spray coverage pattern. They are economical in price and easy to change out, but can be time-consuming if used in difficult cleaning applications.

For more stubborn residues, rotary jet heads with impingement technology optimize water pressure and flow for high-impact cleaning (Figure 4). Using mechanical force, these devices scour the tank interior in a complete 360-degree pattern with a cycle time ranging from 4 to 25 minutes. This method provides effective, repeatable cleaning and consumes the least amount of water, cleaning chemicals and time. Although the change-outs may not be easy and the upfront cost is relatively high, these devices are a fraction of the cost of clean-in-place (CIP) systems, and typically generate a large return on investment (ROI).

Both the rotary spray heads and rotary jet heads are du-



ROTARY JET HEADS



Figure 4. Impingement cleaning uses the mechanical force of the wash fluid to scour tanks clean.

able, easy to use and maintain, and able to be validated per current industry regulations. Key advantages of the rotary devices include:

- Avoiding confined space entry;
- Reducing tank cleaning downtime;
- Decreasing consumption of water, energy and cleaning chemicals;
- Preventing blockages and clogging;
- Eliminating cross contamination;
- Improving productivity, profitability and sustainability.

The rapid return on investment of modern cleaning devices is another advantage. With rotary jet heads, any tote or IBC can be thoroughly cleaned within 2–7 minutes, including the top and corners. By comparison, conventional static spray balls can use 3–10 times the flow rate of a rotary impingement device, and can take 3–10 times longer to complete the cleaning due to their lack of mechanical force.

Alfa Laval offers a free ROI analysis tool to compare the cost of cleaning with existing spray ball methods versus updated impingement technology. “The payback on improved tank cleaning devices is typically under one

year. The ROI tool is an easy way to illustrate how any cost-related concerns are overcome,” says Delaney.

APPLICATION ADVANTAGES

In industrial processing applications such as chemicals, oil and fuel, the primary advantage of mechanical cleaners is that they are designed to withstand tough substances and harsh environments. To effectively clean most industrial machines, Alfa Laval recommends using two nozzles to maximize the impact of each jet. Its industrial models have sealed gear drives that are isolated from the wash fluid. This is critical in applications where wash fluid is recirculated and contains debris, which can clog other cleaning devices. The wash fluid can include water, caustic or solvents.

Sanitary processing applications such as pharmaceuticals have distinct challenges in terms of cleanliness and documentation requirements. Alfa Laval’s Gama-jet and Toftejorg sanitary tank cleaning machines are designed to address the tough materials and finishes of this market, and offer full documentation packages as required for pharmaceutical use. The Sanijet 20 and the EHEDG-approved Sanijet 25, for example, are specifically designed for the pharmaceutical market.

Aftermarket models are also available, though many pharmaceutical applications are hard to modify because the process itself is validated. This makes changing the cleaning process very difficult. New vessel installations or the application of process changes to increase production offer opportunities to maximize the tank cleaning method.

“It is very rewarding to help a company save money and use less resources at the same time through optimized tank cleaning,” says Delaney. “I believe that ‘green’ initiatives such as investments in more efficient cleaning technologies will continue to gain momentum because it is the right thing to do.” ●

Located in Exton, Pa, **GAMAJET**, part of the Alfa Laval Group, provides rotary impingement tank cleaning machines that combine pressure and flow to create high-impact cleaning jets. Visit www.gamajet.com for more information.

Automated Bulk Container Cleaning Trial Pays Off

Chemical company profits from faster cleaning turnarounds and fully clean totes

TOTES AND intermediate bulk containers (IBCs) are used pervasively in processing and manufacturing applications (Figure 1). They are convenient and cost-effective solutions for materials storage, handling and transport.

One U.S. chemical company uses and recycles totes in its shipping and receiving applications. Totes are used to ship the company's products, including surfactants and other chemical compounds for the textile industry, and then cleaned for re-use after the shipment has been delivered. Many raw materials are received from suppliers in totes, which are also cleaned for re-use.

Reused totes must be 100% clean to avoid the dangers and expense of cross-contamination. Cross-contamination is caused when one batch contaminates the next batch, leading to inferior quality products, material spoilage and waste.

TOTE CLEANING DILEMMA

For years, the company's operations director was frustrated by the high cost of sending dirty totes to their tote supplier for refurbishing and cleaning. The alternative, having them cleaned in-house by hand, was even less desirable. Manual cleaning is slower and produces unpredictable results in terms of cleaning quality and effectiveness.

Though the issue was not urgent, the chemical company acquired a Gamajet tank cleaning machine as a result of a business acquisition. The cleaning system was trialed to determine if an economic case could be made for using it rather than sending the totes to the supplier for refurbishment. For the trial to be successful, the machine would have to reduce the time spent cleaning totes in-house, and increase the level of in-house cleaning effectiveness.

CONVINCING ALTERNATIVE

The system exceeded all expectations and the trial was a resounding success. Gamajet systems utilize rotary impingement technology to create full-coverage, high-impact



Figure 1. Totes and intermediate bulk containers such as these are used pervasively in processing applications and often need to be thoroughly cleaned for reuse.

cleaning. Because of the high level of impact, they use less water and cleaning chemicals as they scour tank and tote interiors. A repeatable and reliable 360-degree cleaning pattern ensures the tote is perfectly and completely cleaned, including the top and corners. With its use of mechanical force, the Gamajet takes far less time to clean a tote than methods such as manual scrubbing.

Not only did the automated cleaning system deliver the necessary speed and effectiveness, but it accomplished the goals so well that a second Gamajet was purchased. That purchase paid for itself in just one week.

The chemical company now manages its entire tote cleaning process in-house, saving time and completely eliminating the costs of sending totes out for refurbishing. The cleanings are 25–50% faster with the Gamajet than they were with manual cleaning, and a thorough cleaning is achieved in just 4–8 minutes depending on the amount and type of residue. Most importantly, cross-contamination is no longer a concern, and the company is able to deliver reliable product quality and throughput. ●